REPEATERS SHARING A COMMON MEDIUM FOR COMMUNICATIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is claiming priority of U.S. Provisional Patent Application Serial No. 60/419,174, filed on October 17, 2002, the content of which is herein incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to communications, and more particularly, to an arrangement of for communications on a bi-directional medium. The arrangement is suited for communications over a power line.

2. Description of the Related Art

Many types of communications media are characterized by a single signal medium whose physical continuity cannot be interrupted. There are also communications transducers that are totally bidirectional, as opposed to being omni-directional, or have very limited directionality. Examples include energized electrical power wires, gasses and fluids confined to pipes, and certain optical media.

For example, for power line communications, a signal is coupled to a wire in a non-directional manner, that is, the signal may propagate in both directions along a wire. Often, one direction is an intended direction and the other direction is unintended.

At some distance from a signal source of a signal, a signal to noise ratio will deteriorate to a point that a repeater is necessary to allow data represented by the signal to be conveyed at reasonable quality beyond that point. For a full duplex modem that is continuously transmitting, a receiver can receive signals from both directions, and the possibility exists for signals propagating in an unintended direction to interfere with intended signals.

If multiple frequency bands are available, then the repeater may receive at one frequency and retransmit at another frequency. However, even this arrangement does not ensure immunity from interference, especially if the level of the intended signal is similar to that of the unintended signal, due to similar attenuations between the respective transmitters and the receiver.

SUMMARY OF THE INVENTION

The present invention relates to communications, and more particularly, to an arrangement of repeaters for communications on a bi-directional medium. The system includes a first repeater, a second repeater, a third repeater and a fourth repeater, each of which is coupled to the medium. The first repeater and the second repeater communicate with each other on a first band for a transmission from the first repeater to the second repeater, and on a second band for a transmission from the second repeater to the first repeater. The second repeater and the third repeater communicate with each other on a third band for a transmission from the second repeater to the third repeater, and on a fourth band for a transmission from the third repeater to the second repeater. The third repeater and the fourth repeater communicate with each other on the second band for a transmission from the third repeater to the fourth repeater, and on the first band for a transmission from the fourth repeater to the third repeater.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a configuration of repeaters in a power line communication system.

DESCRIPTION OF THE INVENTION

The present invention relates to communications, and more particularly, to an arrangement of repeaters for communications on a bi-directional medium. The arrangement is described herein in the context of a power line communications system, but can be used on any bi-directional medium, and is particularly well suited for full duplex communications over a single continuous bi-directional medium.

Fig. 1 is a block diagram of a configuration of repeaters in a power line communication system 100. System 100 includes a head-end (HE) 700, a Repeater A 705, a Repeater B 710, a Repeater C 715, and a Repeater D 720. A selection of frequency bands can be used at the various repeaters, so as to reduce an amplitude of an unintended signal relative to that of an intended signal.

HE 700 transmits to Repeater A 705 on frequency Band 1 and listens on Band 2.

Repeater A 705 listens to HE 700 on Band 1 and transmits to HE 700 on Band 2. Repeater A 705 also transmits to Repeater B 710 on Band 3, and listens to Repeater B 710 on Band 4.

Repeater B 710 listens to Repeater A 705 on Band 3, and transmits to Repeater A 705 on Band 4. Repeater B 710 also transmits to Repeater C 715 on Band 2, and listens to Repeater C 715 on Band 1.

Repeater C 715 listens to Repeater B 710 on Band 2, and transmits to Repeater B 710 on Band 1. Repeater C 715 also transmits to Repeater D 720 on Band 4, and listens to Repeater D 720 on Band 3.

By arranging Repeater B 710 to transmit to Repeater C 715 on Band 2 while listening on Band 1, an unintended path 725 for a Band 1 signal from Repeater C 715, traverses two wire segments, namely a wire segment B-C 780 and a wire segment A-B 755. The Band 1 receiver at Repeater A 705 receives its intended signal from HE 700, which traverses one wire segment, namely a wire segment HE-A 750, while the unintended signal from Repeater C is likely to be more attenuated, having traversed two wire segments. Similarly, other unintended paths 760, 765, 770 and 775 span two wire segments, and thus attenuate unintended signals.

There is thus provided a system for communications on a bi-directional medium. For purpose of illustration, regard HE 700 as a first repeater, Repeater A 705 as a second repeater, Repeater B 710 as a third repeater, and Repeater C 715 as a fourth repeater. The system thus includes a first repeater, a second repeater, a third repeater and a fourth repeater, each of which is coupled to the medium. The first repeater and the second repeater communicate with each other on a first band for a transmission from the first repeater to the second repeater, and on a second band for a transmission from the second repeater to the first repeater. The second repeater and the third repeater communicate with each other on a third band for a transmission from the second repeater to the third repeater, and on a fourth band for a transmission from the third repeater to the second repeater. The third repeater and the fourth repeater communicate with each other on the second band for a transmission from the third repeater to the fourth repeater, and on the first band for a transmission from the fourth repeater to the third repeater.

It should be understood that various alternatives, combinations and modifications of the teachings described herein could be devised by those skilled

in the art. The present invention is intended to embrace all such alternatives, modifications and variances that fall within the scope of the appended claims.